SECRET

997385

R & D CATALOG FORM

DATE: 5 January 1965

1. PROJECT TITLE/CODE NAME
Automatic Image Recognition Study (by Coherent Optical Techniques) (Control

2. SHORT PROJECT DESCRIPTION
The project is to determine the feasibility of using holograms (of target images) as spatial filters to automatically identify other targets of the same class.

3. CONTRACTOR NAME [illegible] LOCATION OF CONTRACTOR

25X1

Manufacturer

5. TYPE OF CONTRACT
CPFF

7. FUNDS
FY 1965
FY 19
FY 19

8. REQUISITION NO.
NA

9. BUDGET PROJECT NO.
NP-S-7

10. EFFECTIVE CONTRACT DATE (Begin - end)
January 196[illegible]-July 1965

11. SECURITY CLASS.
A. A. - Conf.
T. - Uncl.
W. - Uncl.

25X1

12. RESPONSIBLE DIRECTORATE/OFFICE/PROJECT OFFICER TELEPHONE EXTENSION

13. REQUIREMENT AUTHORITY

14. [illegible] WORK TO BE DONE

15. CLASSIFICATION OF EFFORT

MAJOR CATEGORY

SUB-CATEGORIES

16. [illegible] ITEM OR SERVICES FROM THIS CONTRACT/IMPROVEMENT OVER CURRENT SYSTEM, EQUIPMENT, ETC.

17. [illegible]RTING OR RELATED CONTRACTS (Agency & Other)/COORDINATION

18. [illegible]PTION OF INTELLIGENCE REQUIREMENT AND DETAILED TECHNICAL DESCRIPTION OF PROJECT (Continue on additional page if required)

19. APPROVED BY AND DATE

OFFICE	DEPUTY DIRECTOR	DD/I

FORM 11-64 2338

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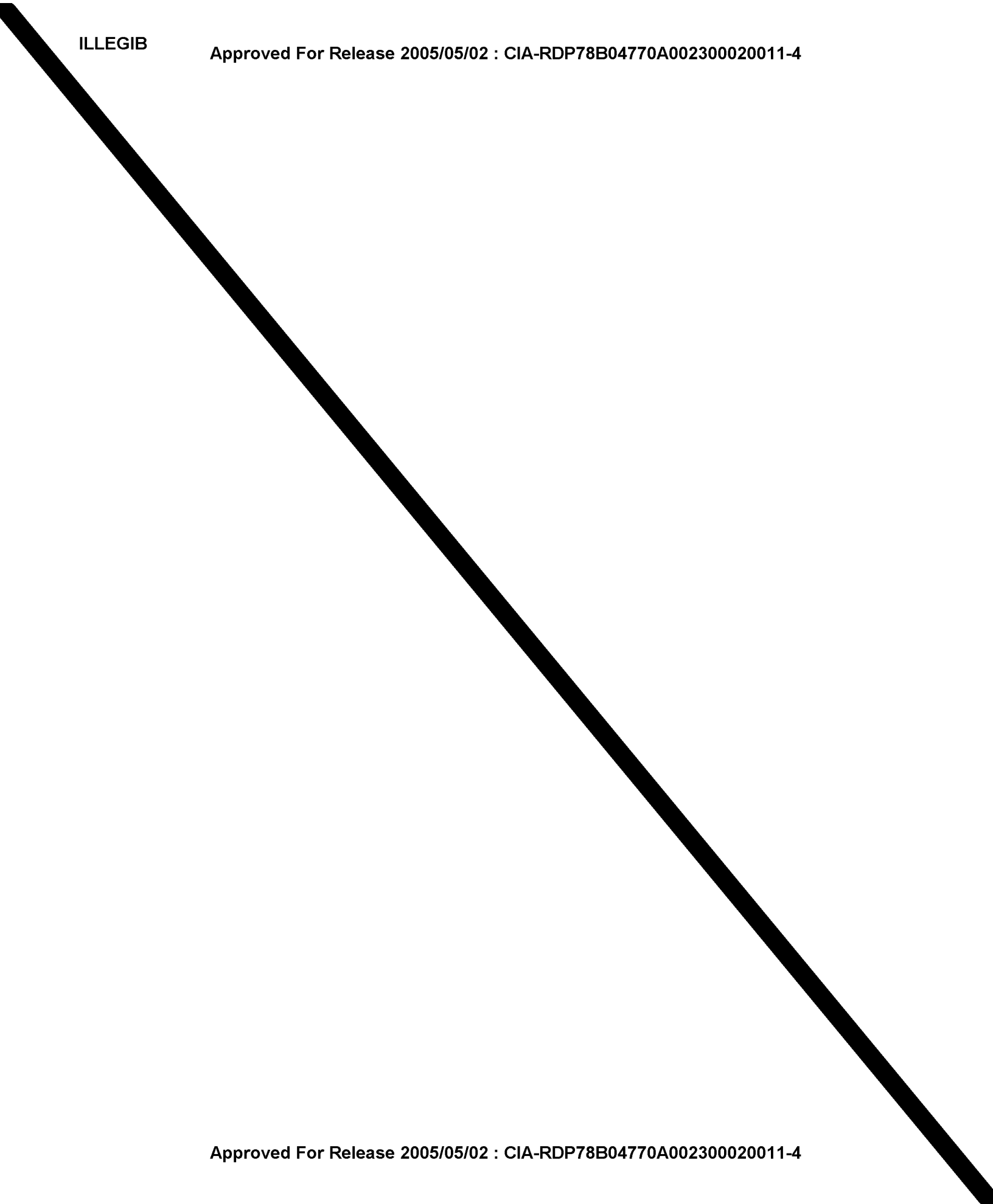
GROUP 1 Excluded from automatic downgrading and declassification

(1-13)



Approved For Release 2005/05/02 : CIA-RDP78B04770A002300020011-4

(When Filled In)

AUTHORIZATION TO EXPEND FUNDS FROM OTHER COMPONENTS ALLOTMENTS

DATE

TO : Assistant Director, OSA-DD/S&T
THRU : (A) Chief, Budget & Finance Branch, OSA-DD/S&T
ATTN : (B) Chief, Comptroller Division, OSA-DD/S&T

SUBJECT : Request for Cover Contract

REFERENCE: Anti-Satellite Reconnaissance Study with Aerospace

5004

SUPPORT, OR SERVICES, TO BE PROVIDED

1. It is requested that the Contracting Officer, OSA-DD/S&T negotiate a contract with [redacted] on behalf of NPIC in an amount not to exceed [redacted] the details of which have been furnished separately.

2. Due to the cover nature of this activity the contractual and financial administration of these funds should follow presently established OSA procedures. A duly appointed OSA approving officer should approve such payment.

3. The amount stated above has been obligated and will be reported in the Summary Obligation Reports submitted by this office. The funds should be posted to the Allotment Number and Obligation Reference Number cited below.

4. If property is obtained from this contract, receiving reports will be obtained (and sterilized if necessary) and copies will be forwarded to the Office of Logistics and the Finance Division to insure recording in the Property Accounting System.

5. This project was approved by A/DDI (Management) on 5 November 1964.

Distribution:
Orig. & 2 - Addressee
1 - P&DS
1 - BFAB/MSS
1 - Requisition Folder
1 - Requisitioning and Procurement Folder
1 - Chrono

NPIC/SS/LB [redacted] 13 November 1964)

CHARGEABLE TO 55X-6010-65

PROJECT

ALLOTMENT NO. 5.55-410

OBLIGATION REFERENCE

A. EXPENSE | B. 144.1 ACCOUNT

SIGNATURE OF ACCOUNTABLE OFFICER

FUNDS AVAILABLE

SIGNATURE OF BUDGET OFFICER

IF CHARGEABLE TO ACCOUNT NO. 144.1

FORWARD RECEIPTS SUPPORTING EXPENSES TO

ROOM NO. | BUILDING | EXTENSION

SIGNATURE FOR FINANCE DIVISION

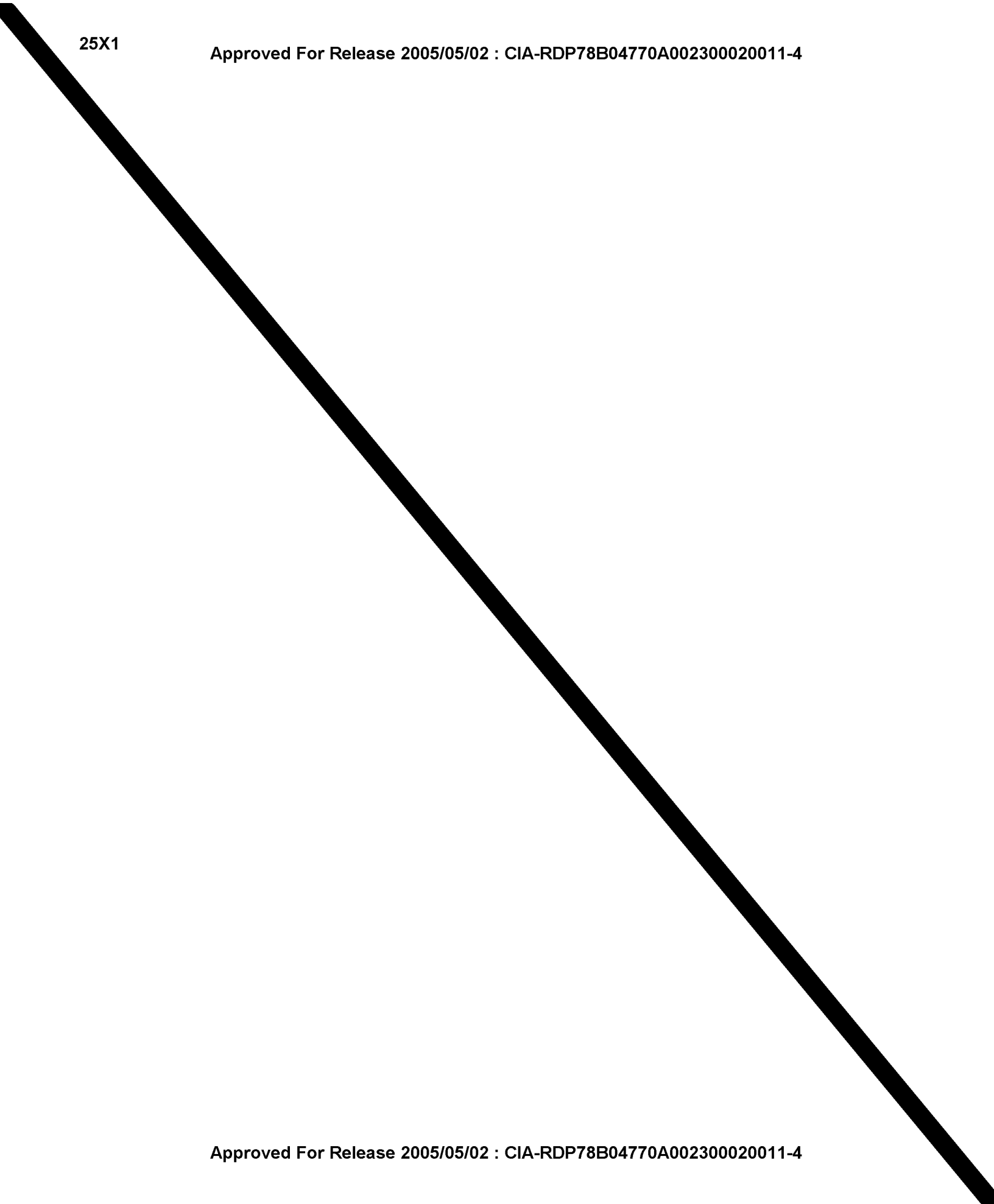
25X1

FORM 1716 USE PREVIOUS EDITIONS

SECRET

GROUP 1 Excluded from automatic

(3)



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[redacted] 25X1

Copy [redacted] of 35 Copies

Research and Development
Project Approval Request

I. Identification

This project concerns laboratory research and electro-optical experimentation to determine the feasibility and problem areas of utilizing holograms of images as a possible technique for semi-automatic image recognition. This project is included in the Technical Development Program of the P&DS, NPIC for FY-65, as part of a [redacted]tem under Special Techniques and Development Studies. 25X1

II. Objectives

The primary objective of this project is to prove or disprove the usefulness of holograms when they are used as spatial filters in an image recognition system. The proposed program is based upon an approach using a laser, an optical bench, and a high resolution image orthocon tube. It is strictly a laboratory study to test feasibility and will not produce deliverable hardware at this stage.

III. Background

The rate of acquisition of reconnaissance materials is steadily and rapidly increasing. Acquisition processes are already automated to a great degree so that the number of people required to exploit these materials greatly exceeds the number involved in its acquisition.

The following expansions in acquisition are contemplated:

(1) Extended coverage of the Sino-Soviet Bloc, with 5-10 foot ground resolution, with frequent missions.

(2) Surveillance coverage of 2000-3000 priority targets.

[redacted] 25X1

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[redacted]

All of these planned requirements dictate that the overall exploitation process will have to be accelerated, while maintaining accuracy and complete reporting. One means of accelerating the process is to provide to the interpreters automatic or semi-automatic aids. These devices should be able to perform the more routine, redundant and time consuming tasks of interpretation. This would allow the more efficient use of interpreters to perform the more complex interpretation tasks. Some of the tasks which may be susceptable to automation include: counting of similar objects (e.g., railroad cars or automobiles in an area); re-scanning large volumes of film to search for a particular type of object; elimination of cloud obscured areas and other sterile coverage, etc.

This investigation would be one of several being performed by the Intelligence Community to evaluate various techniques which may be applicable to the development of automated devices which would aid the interpreter in performing his image recognition tasks. Many of these techniques under investigation are primarily linear processes based on the sequential examination (by an electro-optical system) of each bit of data in the total image and the subsequent comparison of these bits to a previously learned prototype image of a target. Foremost of this type of image processing are the adaptive-memory devices such as the Perceptron and other similar computers. Although these types of devices can automatically identify targets, they seem to have several serious deficiencies:

(1) Linear processing techniques are very bandwidth-limited -- e.g., the time of processing per unit of image area per image-packing density is very long. In other words, an electro-optical, adaptive-computer system requires more time to identify an image than does a poor or mediocre human interpreter. A human interpreter does not examine an image bit by bit but by integration of many hundreds or thousands of image bits simultaneously.

(2) Adaptive memory techniques have shown little capability to "generalize" from a learned prototype image. They are unable to recognize an image which differs appreciably from the learned prototype due to shadow, perspective, and incomplete or distorted image detail.

It is primarily because of these two deficiencies that it is necessary to investigate completely different concepts which might be applied to image recognition.

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Recent research has demonstrated that certain types of optical filters for specific images will permit recognition of only that image when it is viewed in a scene containing other "unwanted" objects. This type of filter is essentially a diffraction image of the object, more commonly called a hologram. These types of spatial filters, or holograms, permit the entire image to be "processed" simultaneously; therefore, the speed of recognition would be reduced considerably over that of linear recognition systems. There is also some indication from laboratory work that recognition with these filters is little affected by perspective and incomplete image detail.

Although the basic concepts of spatial filtering have been demonstrated, there are many questions remaining that must be solved before the technique can be fully evaluated and related to a possible automatic recognition system. The purpose of the proposed research is to investigate these more salient unresolved problems.

Technical Specifications

The project shall basically consist of laboratory experimentation to answer the following questions:

(1) Determine how obscure a target can be, in contrast as well as obscuration, and still be recognized.

(2) Determine experimentally how much information a photograph can contain before the hologram or spatial filter fails to recognize the desired target.

(3) Determine what effect shadows have in the image recognition process.

(4) Determine experimentally the tolerance between the scale of the target in the photograph and the scale of the target for which the spatial filter was made.

(5) Determine experimentally the tolerances of target perspective.

(6) Determine the effects of image packing density.

(7) Determine the tolerances or limits of target orientation.

(8) Determine the effects of multiple, identical targets in the same field of view.

(9) Determine how many different types of targets can be made into one multiple spatial filter.

(10) How seriously does the insertion of glass plates affect the optical performance.

(11) Investigate the use of liquid gates with photographic films.

(12) Determine how seriously vibration affects the optical system performance.

(13) Determine the feasibility of photoplastic film as a recording medium.

(14) Determine how accurately the filter must be located and aligned for best recognition.

(15) Study the various means for reducing the amplitude of the reference beam of the two-beam interferometer used to produce spatial filters.

(16) Determine the relative merits of phase and amplitude filters.

(17) Determine what the expected resolution limits of the hologram system are.

(18) Determine what the system time constants are for a scale and orientation search for a target.

(19) Analytically determine the optimum modulation transfer function of a recognition system.

(20) Determine the effects of signal-to-noise ratio on the read-out system.

(21) Investigate the feasibility and complexity of real-time filter generation.

(22) Make a system evaluation which will make use of the various pieces of data gathered from the aforementioned studies.

V. Contractual Arrangements

Since much of the knowledge of holograms to date has been developed in-house at the [redacted] 25X1
25X1 [redacted] it is recommended that [redacted] be awarded 25X1
the contract with the provision that [redacted] 25X1
25X1 [redacted] be retained as a consultant on this project. He has

25X1 [redacted]

agreed to this arrangement. The Image Orthocon System [redacted] 25X1
was developed for the Agency for another contract for which it is no longer
needed. DD/S&T/ORD has agreed to [redacted] using it for this project as GFE 25X1
equipment. The proposed cost of this project is [redacted] It would be 25X1
25X1 an add-on task to [redacted] basic Agency contract.

VI. Coordination

The idea for investigating holograms for this purpose was conceived internally and, to our knowledge, no other Agency has any plans for similar investigations. Other units of the Intelligence Community will, of course, be informed of significant progress in this project.

VII. Security

The project itself would be unclassified at this stage of investigation, although its association with the sponsor would be CONFIDENTIAL. All personnel to be associated with the project have Agency SECRET clearances.